

Serum 1,1-dichloro-2,2 bis(4-chlorophenyl)ethane (p,p'-DDE) Concentrations in Former Farmworkers From the Lake Apopka Region of Central Florida

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Introduction



Persistent organochlorine pesticides (OCPs) were applied for years to fruit and vegetable farms that were reclaimed wetlands on the North Shore of Lake Apopka in Central Florida (Figure 1). OCPs that were applied included 1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane (p,p'-DDT); DDT and its metabolites, p,p'-DDE and p,p'-DDD (Figure 2), are remarkably persistent in the environment. DDT was banned in the 1970s because of adverse effects on wildlife, however a 2011 study of the Lake Apopka area showed that **post-remediation** of the North Shore Restoration Area, DDT remains in soil at levels up to 40 mg/kg (1). Concerns voiced from former farmworkers focused on adverse health effects that may be related to possibly elevated incidence of systemic lupus erythematosus (SLE) in the region, prompting this study.

Figure 1: Lake Apopka showing the location of some North Shore former farms: some of this area has been reclaimed as wetlands. Inset shows the location in Florida.

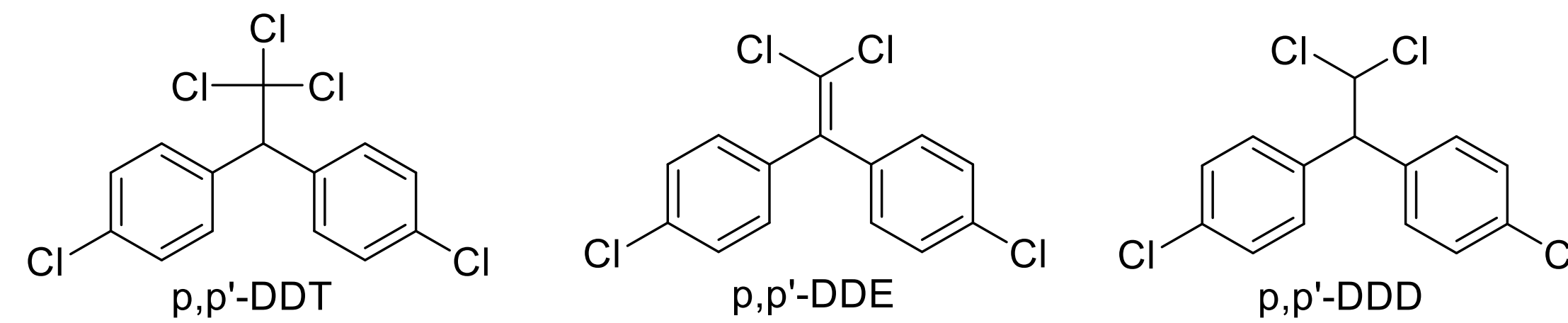


Figure 2: Chemical structures of DDT and its metabolites.

Participants

Twenty former farmworkers provided blood samples and responded to an in-person questionnaire. Participants were mostly female (19), and African-American (16) or Hispanic (4).

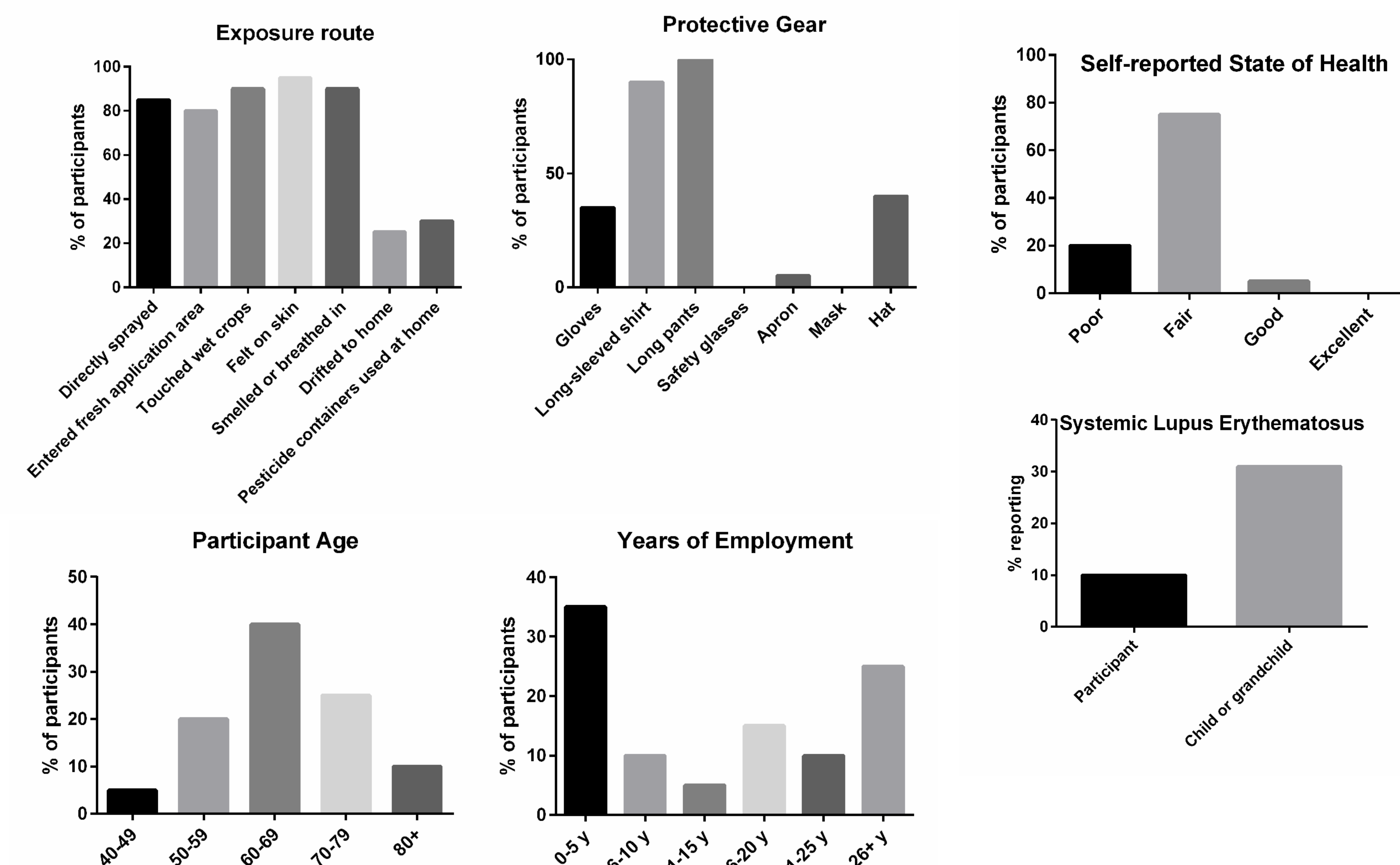
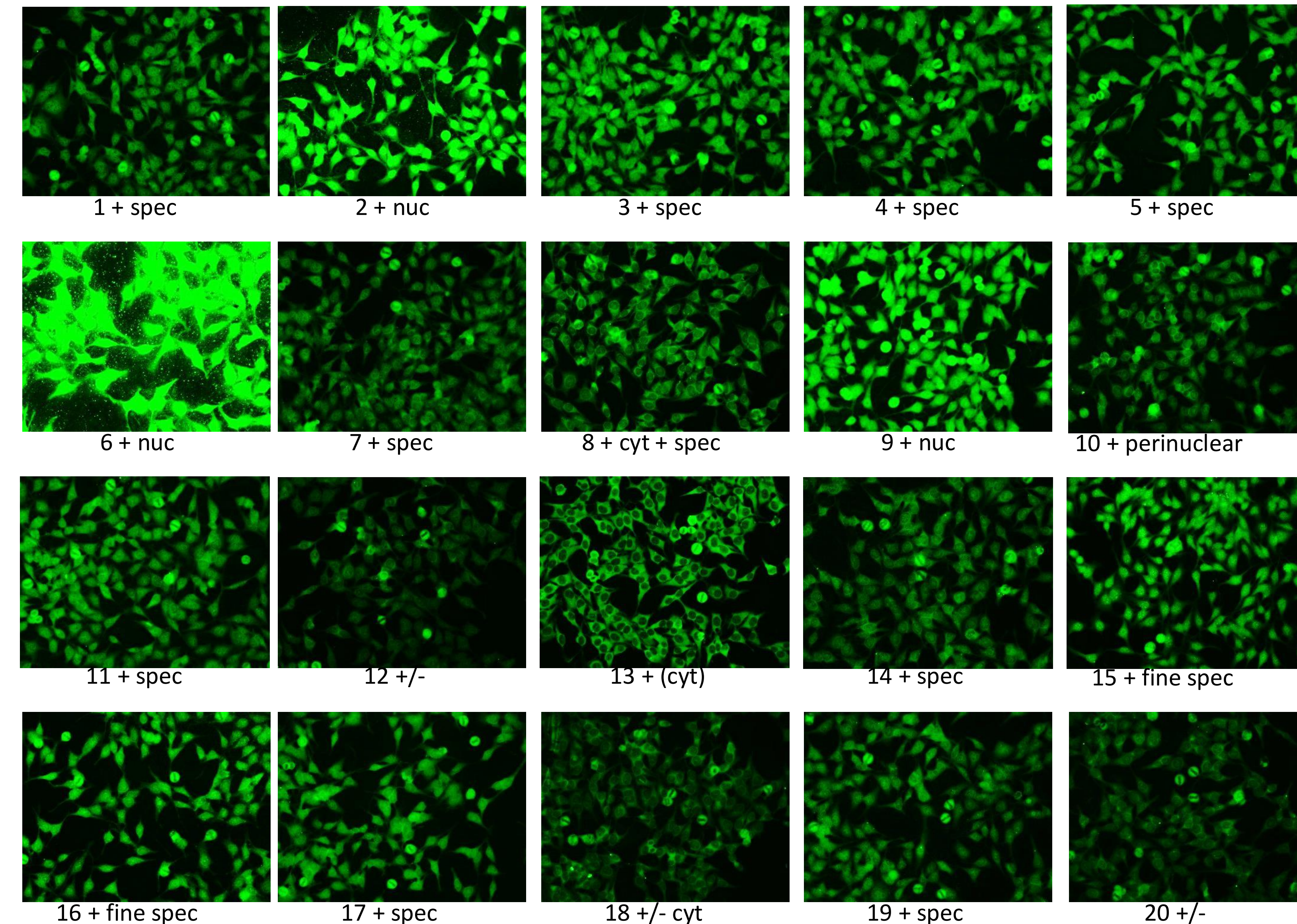
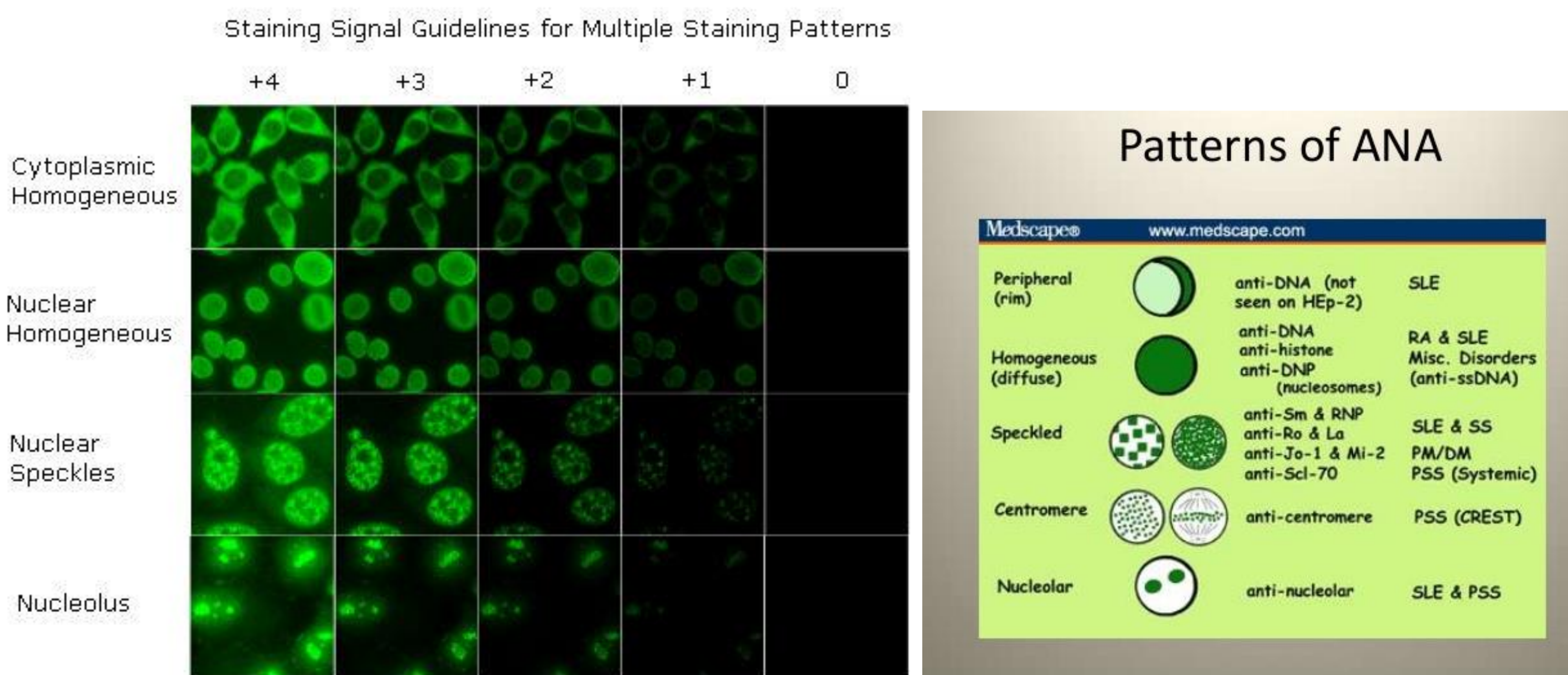


Figure 3: Self-reported participant exposure, demographics and health data from survey.

Results



Anti-nuclear antibody staining in participant serum (diluted 1:80). ANA staining patterns are labeled below each fluorescent photomicrograph. All but 3 participants were considered positive for the presence of ANAs. Participants 2 and 6 had previous clinical diagnoses of systemic lupus erythematosus (SLE).

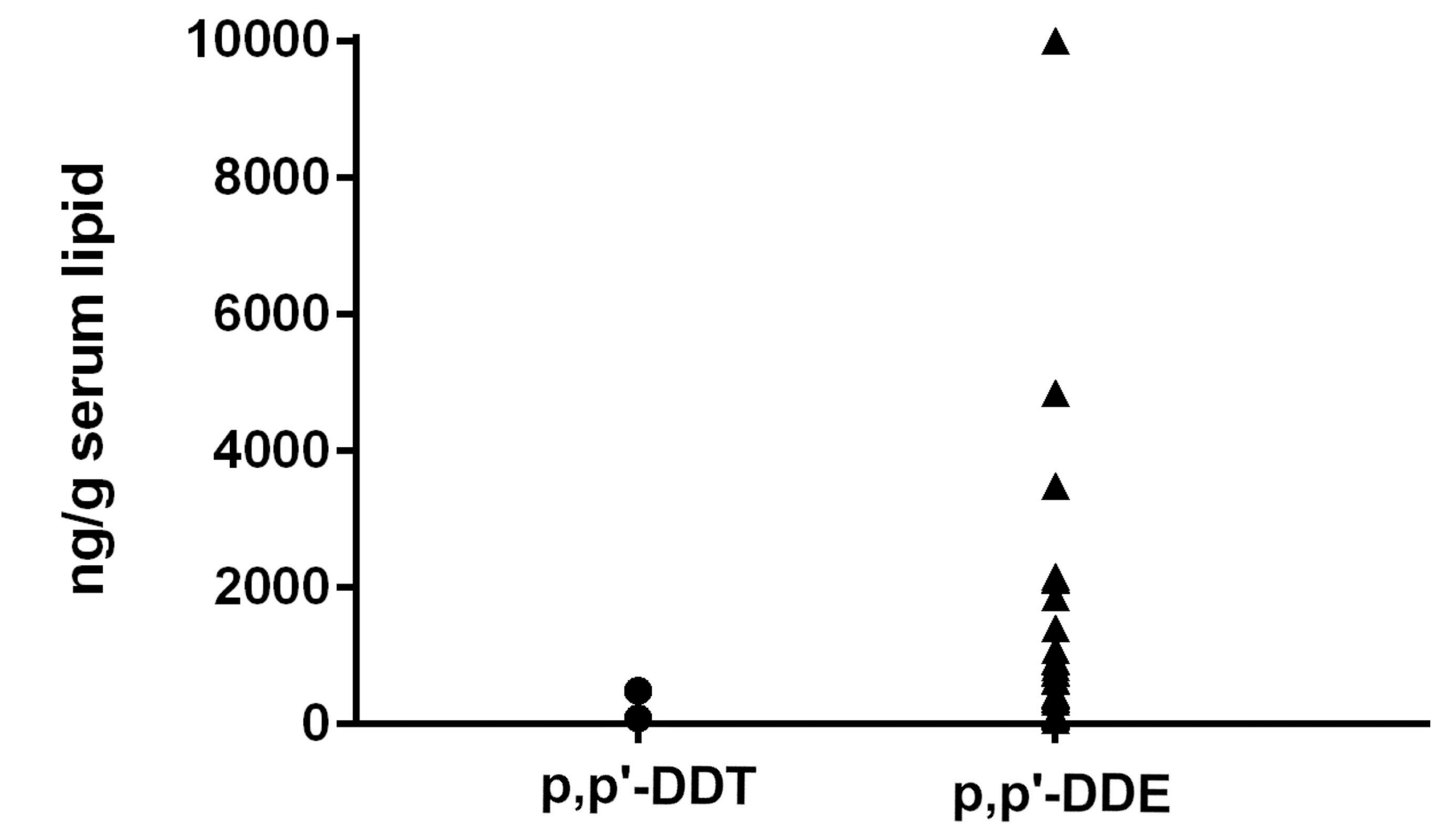


LEFT: Panel showing ANA staining pattern guidelines for scoring cytoplasmic and nuclear observations.

RIGHT: Further interpretation of ANA staining patterns including associated health outcomes including lupus (SLE), rheumatoid arthritis (RA), primary Sjögren's syndrome (PSS), polymyositis (PM) and dermatomyositis (DM).

References

1. Tucker WA, Dudley JL. Human health risk assessment update. Lake Apopka North Shore Restoration Area (NRSA), Lake and Orange Counties, FL. In: District SJRWM, editor. Newberry, FL: AMEC E&I, Inc.; 2011. p. 229.
2. Satoh M, Chan EK, Ho LA, Rose KM, Parks CG, Cohn RD, Jusko TA, Walker NJ, Germolec DR, Whitt IZ, Crockett PW, Pauley BA, Chan JY, Ross SJ, Birnbaum LS, Zeldin DC, Miller FW. Prevalence and sociodemographic correlates of antinuclear antibodies in the United States. *Arthritis Rheum.* 2012;64(7):2319-27



Individual concentrations of p,p'-DDE in the participants. The range was 65 to 10,003 ng/g lipid. Two individuals had detectable p,p'-DDT in their blood.

Below: Lipid-adjusted serum concentrations of p,p'-DDE as ng/g lipid in individuals over age 20 from NHANES and from the current study.

Data source	Geometric mean	50 th percentile	90 th percentile	95 th percentile
NHANES 1999-2000	297	269	1280	2020
NHANES 2001-2002	338	285	1480	2550
NHANES 2003-2004	268	233	1270	1990
NHANES Non-Hispanic blacks 2003-2004	262	216	1620	2860
This study 2014	746	798	4714	9746

Summary

- Mean serum DDT from former farmworkers was higher than national statistics derived from NHANES.
- Rate of ANA cross-reactivity in the 18 group members with no SLE diagnosis was 83%. This is substantially higher than the NHANES 17% seen individuals older than 50, and 22% for non-Hispanic blacks age 50 and older (2).